FROM FOSSIL FUELS TO RENEWABLES -- (House of Representatives - March 15, 2007)

The SPEAKER pro tempore. Under the Speaker's announced policy of January 18, 2007, the gentleman from Maryland (Mr. Bartlett) is recognized for 60 minutes as the designee of the minority leader.

Mr. BARTLETT of Maryland. Madam Speaker, I want to talk about a subject today that at least five groups in our country have a common cause in. They come from quite different perspectives, but they all end up at the final common pathway. And these groups are those who are concerned with national security. They are concerned because our country has only 2 percent of the known reserves of oil in the world, and we use 25 percent of the world's oil and import almost two-thirds of what we use. And as the President says, we get a lot of that from countries that don't even like us.

And so those who are concerned about national security are urging that we make a transition from these fossil fuels, most of which are owned by countries over there, and move to renewables so that we can have a sustainable source of energy for our country from a national security perspective.

There is a second group of people who believe that our burning of these fossil fuels is polluting the environment to an unacceptable level. And it is not just the greenhouse gases, because that introduces us to a third group. But it is all of the other pollutants that come in the atmosphere as a result of using these fossil fuels in all the ways that we use them to produce energy, coal, fire, power plants, our automobiles, our trains, heating our buildings, all the ways that we use energy.

By the way, you can make an argument that even if you are producing more CO2, that may not produce global warming if you are producing it by burning hydrocarbons in a way that puts a lot of other pollutants up in the atmosphere.

I remember a number of years ago when Carl Sagan, the great astronomer, was noting that if we had a nuclear war we might go through what he called nuclear winter; and the trash thrown up into the atmosphere as a result of the nuclear explosions, he

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thought, might block enough of the Sun's rays that there would be a cooling of the Earth so that we would go through a kind of an ice age. Indeed, there is some natural phenomena that give some credibility to that possibility.

Whenever there is a major volcano that goes off, an eruption that throws millions of tons of trash up there that may circulate for a couple of years before all the fine particles finally come down, we can see a degree or two of temporary

cooling in the Earth as a result of that. So there is the environmental group that is concerned about our excessive burning of these fossil fuels and the pollutants that come from that, and they are very interested in conservation, in efficiency, and moving to true renewables.

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And then there is the growing group of those who are concerned that the release of these greenhouse gases, CO2 being one of the major ones, is warming our Earth.

Now, it is true that our Earth is warmer than it has been in the last 10,000 years, since the last Ice Age, and maybe as warm as it has been, some say, in the last million years if in fact we have been here that long. It is not certain that there is a cause-effect relationship between CO2 and warming.

But when you go back through history, and they do this in Antarctica by doing ice borings, and that is a desert down there; they have less than 2 inches of precipitation per year; it doesn't fall as snow, it falls as tiny little ice granules, and that accumulates very slowly. There is nearly 2 miles of ice piled up at the South Pole down there. And so with borings you can go in there and you can look back through tens of thousands of years, and the scientists can tell pretty much what the climate was like and what the temperatures were by the kinds of materials that were deposited there during that time. And they note that every time that CO2 was up, the Earth was warmer. So that at least is a presumptive evidence that CO2 certainly as a greenhouse gas is the cause of the present global warming that we are looking at.

And, of course, what the global warming people want is to move away from fossil fuels, because what we are doing with fossil fuels is releasing into the atmosphere carbon dioxide that was sequestered by plants a very long time ago.

As a little boy, I knew that that is what was happening, because we lived up in western Pennsylvania and we had a coal furnace; as a matter of fact, we didn't buy it, we mined it on our own farm.

There was an abandoned mine on the farm and we got the services of a miner in the little local town and he opened up the mine and we shared the coal that he got from it, and we would use coal as it came from the mine, some big chunks and down to very small ones, and some were too big to put in the furnace. And as a little boy, when it was my time to tend the furnace I would have to go down and sometimes break a lump of coal so that I could get it into the furnace.

I remember taking that sledgehammer that stood by the wall there and breaking the lump of coal, and once in a while it would open up and there would be a fern leaf. I remember as a little kid looking at that fern leaf and wondering, how long ago did that fern live and die and fall over and now be compressed under dirt and with time it finally converted to coal? So as a little boy I knew that the coal that we were burning came from plants that lived a very long time ago, and they had sequestered the CO2 then over thousands of years perhaps.

And now what we are doing in a relatively few years, because we are in the age of oil, only about 150 years now in the age of oil, and we are now releasing into the atmosphere all the CO2 that has been taken out of the atmosphere over a very long time period.

So what the global warming concerned people are interested in is an energy economy that uses the energy that we are producing. If you are burning the tree that grew, you are now releasing into the atmosphere the CO2 which the tree took out of the atmosphere. So although, and if it was possible, I am not sure that it is, that we could get as much energy from these alternative renewable sources that we are now getting from fossil fuels, you can use them to your heart's desire and you wouldn't increase the CO2 in the atmosphere because for every pound of CO2 that you released into the atmosphere, that pound was taken out of the atmosphere by the tree or the grass or whatever grew that you were getting energy from.

And so what the people concerned with global warming want us to do is to move as quickly as we can from fossil fuels to these renewables. So they have common cause with the environmental people and with the national security people.

And then there is a group of people growing, not large yet but growing, who believe that, even if you don't have any concern about the environment, even if you don't have any concern about global warming, even if you don't think that it is a national security risk to be getting so much of our oil from over there, it just isn't going to be there because we are going to have such a phenomenon as peak oil. By the way, our country reached that plateau in 1970. We will talk about that in a few moments.

And then there is a fourth group that really ought to have common cause here, and that is the group that is concerned about what could America do to get back as a premier manufacturing Nation? And you know that we are not now, because all you have to do is to look at the cars on the road and where they are made, and I think more than half of them are now made overseas. And all you have to do is go into a store and buy things and just look at the tag at where it is made. And I have to look and look and look to find something that is made in the United States anymore. You would make a lot of money if your wager was that the first

thing you pick up is going to be made in China, because almost always the first thing you pick up is made in China.

So we desperately need an area in which we can be premier, in which we can export to the world, and I would submit that that would be in the energy efficiency and alternative energy area. There is no society in the world that is half as creative and innovative as the American people if we are challenged and if we see the need and if we see the goal.

So I wanted to talk today about this phenomenon which I think that these five groups have common cause in: Those that are concerned about national security, those that are concerned about the environment and isn't our air polluted enough, those that are concerned with global warming, those that believe that by and by the oil just isn't going to be there, the Moon isn't made out of green cheese and the Earth isn't made out of oil and, quite obviously, it is not going to last forever, and then the group that is looking for something where we can again become a premier engineering and manufacturing Nation. And, of course, we have now relinquished that premier position to other parts of the world.

The first chart that I have here kind of explains a lot of our dilemma, the World According to Oil. And I found this, and I found it so intriguing that I have shown it now a couple of times. But what this does is to show you what our planet would look like if the size of the nation was relative to how much oil it had. And, boy, do we have a warped geography here.

Here is Saudi Arabia, and it dominates. Look how big Saudi Arabia is. How many times could we put the United States in Saudi Arabia, 20? That is about how much more oil they have than we have. Canada looks pretty big here; they have got a meaningful amount of oil compared to the lower 48, compared to their size. Look at Venezuela down here, it just dwarfs the rest of South America. And look at the North of Africa here.

The countries that we think of as being important in the world economy like England and Europe and so forth, look at them there, they look like little splotches here on the globe if the countries were sized according to the amount of oil that they have.

Iraq. So you can see why people are concerned about Iraq, it is a pretty big reservoir of oil. Little Kuwait. If you look at a map of that part of the world, you will see that Kuwait, and Saddam Hussein thought that it looked like a province down there in the most southeastern part of Kuwait that he wanted

to reclaim it and that is why he went in more than a decade ago, but it is tiny compared to Iraq. You could fit the United States into Kuwait five, six times. Here

is Qatar, a little nation so small you can hardly see it on the globe but there it is probably as large as the United States. Iran, now problems with Iran, note how large Iran is.

Something of particular note on this. The two countries that contain about 2 1/2 billion people total, more than 1 billion now in India, and 1,300,000,000 in China, and look at how big they are relative to oil. Russia north of them, which has only 140 million people, dwarfs them. By the way, notice how big Russia is, 1 1/2 or maybe twice as big as the United States, it doesn't have all that much oil. We have only 2 percent of the known reserves, this is about 2 percent of that total volume of oil nations there. And Russia looks big as an oil exporter because they don't use that much oil so they can export, but they really don't have all that much oil compared to countries like Saudi Arabia and so forth.

The next chart is a prediction that was made by a very famous speech that was given 51 years ago the 8th

day of this month. And I will submit that, within a decade, this may well be recognized as the most important speech given in the last century. It was a speech given by M. King Hubbert, who was an oil geologist and he worked for the Shell Oil Company. And there was a convention of oil people in San Antonio, Texas on the 8th day of March 1956, and he got up and gave an absolutely audacious speech. It was inconceivable and unbelievable when he gave the speech.

What he said was that the United States, and if you look back in your history at that point in time we were king of oil; we were producing more oil and I think exporting more oil than any other country in the world. And he predicted that this giant in oil would reach its maximum production of oil in just about 14 years, and he was predicting that by about 1970 we would reach our maximum production of oil.

Now, he was talking only about the lower 48. He couldn't imagine at that time that we would be able to go out and drill in the Gulf of Mexico where there are now 4,000 oil wells, I think, and he did not take into account that we might find oil. I expect the technology for getting it out of there probably would have been very difficult at that time. So he was predicting the lower 48. And that would be everything here of the rest of the U.S. and Texas. You see how big Texas was here. Maybe a third in total oil we have ever produced has come from Texas. And that would be the lower 48.

As you see, right on schedule in 1970, his prediction came true. That shocked a lot of people. And whereas he had been an object of ridicule before that, now he became kind of a legend in his own time.

And then we found that huge strike of oil in Alaska in Prudhoe Bay up at Dead Horse, I have been there; I saw the beginning of that 4-foot pipeline, through which for a number of years now about one-fourth of our total oil has flowed. And then the nongas liquids you see up here. If you add those two in, there was just a bump on the way down the other side of Hubbert's Peak.

And here we are today. In the lower 48, we are producing considerably less than half of the oil that we produced in 1970. And if you even add to that the liquids made from gases and the Gulf of Mexico oil, now that is recent enough that people can remember that, and you may remember the hype that went on over that. Gee, we don't have to worry about oil for the foreseeable future. We found this enormous amount of oil in the Gulf of Mexico; and, as I mentioned, there are about 4,000 oil wells there. Notice that hardly made a blip in our slide down the other side of Hubbert's Peak.

The next chart shows a depiction of Hubbert's Peak, and this is from a very interesting publication. This is in a publication by CERA. Now, CERA is one of the few organizations that believes that you don't need to be worrying about oil for the next number of years, and they have this chart in their publication and they intend to repudiate and ridicule M. King Hubbert with this chart. And they are saying that M. King Hubbert couldn't have been right because look at the actual data here.

Now, this is the total U.S. production, the red, and the yellow is the Hubbert's lower 48. And what he is saying was that Hubbert must have been all wrong, because the actual lower 48 production are these green things down here, and they think that is far enough away from the yellow that his prognostication is repudiated by this.

I would think the average person looking would say, well, gee, he was right on. Wasn't he? He said it was going to peak in 1970, that is 1970. He said it would go downhill after that. Well, it didn't go downhill quite as fast as he thought it would, but it certainly has gone downhill after that. Maybe he couldn't have imagined that we would drill more than 1/2 million oil wells in this country. We have more oil wells drilled in this country than all the rest of the world put together.

Now, the red here reflects that contribution from Prudhoe Bay and from the Gulf of Mexico that we saw in the previous one, that little blip going down the other side of Hubbert's Peak.

Mr. MARKEY. Will the gentleman yield?

Mr. BARTLETT of Maryland. I would be happy to yield to the gentleman from Massachusetts.

Mr. MARKEY. I would like to say that the gentleman from Maryland is like Socrates up here lecturing to the Members and to the country on this incredibly important issue. And I would just like to take note that you do it day after day, and you are relentless.

There is no question that, still, there is this denial with regard to the amount of oil that the United States has in terms of reserves compared to OPEC, compared to Russia, compared to other countries in the world.

[Time: 15:15]

And the gentleman from Maryland on a consistent basis comes here to the House floor. I know you do it in other places to bring this message. And if I may, just for 10 seconds because I know the gentleman shares my view on this, I think we both drive hybrids. I think the gentleman is the Chair of the Hybrid Caucus, as a matter of fact. And we both know that the technology exists if we make a commitment as a nation. So here is just one little statistic I would like to put out there:

In 1970, the United States imported 20 percent of its oil; 80 percent we produced. By 1977, just 7 years later, we imported 47 percent of our oil. We went from 20 percent imports to 47 percent imports. But then the Congress and Gerald Ford, President Ford, passed legislation which mandated a doubling of the fuel economy standards for the United States of America. By 1985, 1986, we had dropped back down to 27 percent imports. So we went from 20 percent to 46 back down to 27 percent because we improved our technology. We doubled the fuel economy from 13 miles per gallon to 27 miles per gallon. We did it technologically.

Today, unbelievably, the United States imports 60 percent of its oil. So from 1986 to 2006, we went from 27 percent of our oil that we imported to 60 percent of our oil that we imported. And as the gentleman graphically, in eye-watering detail, continues to present out here on the House floor, the places from which we import this oil is not healthy for the United States of America. It is an unhealthy relationship with countries that we should not be dependent upon. Three hundred billion dollars worth of oil imports last year. Three hundred billion dollars. And we know that much of that money is spent on things that are completely adverse to the overall national security interests of the United States of America even as we emit more greenhouse gases out into the atmosphere that we would not be emitting if our fuel economy standard was much higher.

So I saw you out here again like a preacher, and I thought that I would just let you know that I am out here in the congregation listening to you, and I know that there are many, many other people who are very much in debt to you for having

the resolute commitment to getting this message into the minds of the American people.

So I thank the gentleman for yielding.

Mr. BARTLETT of Maryland. Mr. Speaker, I thank the gentleman very much for his kind words.

This is, in fact, the 25th time that I have been here. And, wow, it was the 14th, just about a year ago I came here

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for the first time, the 14th of last month, March. And we were putting our charts together and we were trying to decide what to call this phenomenon. Were we going to call it the ``great rollover,'' when you reach the top and start down the other side, or were we going to call it ``peak oil''? And we had a long conversation in the office about what we should call it, and we finally decided we would call it ``peak oil.''

Now, I didn't know that there were some other people out there already calling it ``peak oil'' because I am a whole lot wiser now than I was then, but this kind of indicates the status of the recognition of the problem a year ago, and I was one of the more interested people in the Congress in this and I didn't even know what to call it. I was arguing with myself and with the staff. We were discussing it. Should we call it the ``great rollover,'' and it will be a great rollover, or should we call it ``peak oil''? We finally settled on ``peak oil,'' and now today there is an increasing number of people who are concerned about peak oil.

Mr. MARKEY. Will the gentleman yield?

Mr. BARTLETT of Maryland. Yes, sir.

Mr. MARKEY. Why do you think it is so hard to convince people that we don't have the oil reserves that would allow us to have a healthy relationship with the rest of the world that does have the oil reserves that ultimately we are going to need to import if we don't change our habits? Why do you think our country doesn't come to grips with that? Where is the gap in communicating with the American people on this issue?

Mr. BARTLETT of Maryland. Well, thank you. I think there are several reasons for this. One is an irrational confidence, worship almost, of the marketplace, and technology. And the third is that people just don't like to think about tough, hard things. I love to think about those things because there is no exhilaration like the exhilaration of meeting a big challenge and overcoming it. So this is exhilarating to me, and there are many people that don't like this. And my wife tells me that I shouldn't be doing this because don't you remember that in ancient Greece they

killed the messenger that brought bad news? And my response is this is a good news story. If we start today, we will have a less bumpy ride than if we start tomorrow.

Mr. MARKEY. Will the gentleman yield?

Mr. BARTLETT of Maryland. Yes, sir.

Mr. MARKEY. You tell your wife that in Massachusetts the messenger's name was Paul Revere and we actually built statues to him up in Massachusetts for telling us the Red Coats were coming, the British were coming, the regulars were coming. And that is what you are telling us right now, that at 60, 61 percent dependence upon imported oil, we are heading inexorably towards a very, very dangerous foreign policy, national security crisis in our country because we are averaging about 1 1/2 percent per year increase in our dependency. So in order to move from 27 percent back in 1985, 1986 to 60, 61 percent today, it just has to go up that much. So if we come back here in 67 years and we haven't done anything, we will be over 70 percent, 75 percent dependent upon imported oil, all unnecessary if we looked at the facts and looked at the facts today and began to change our national habits.

So tell your wife that Paul Revere is more likely the analogy that applies to you rather than the messenger that they shot.

Mr. BARTLETT of Maryland. I want to thank my friend for joining me. This is absolutely a bipartisan issue. I don't know that energy and oil knows the difference between a Democrat and a Republican. So I am very pleased that you joined me on the floor.

I might say just a word about these two philosophies that are keeping us from really focusing on this issue. One is an almost reference for the marketplace. There are many people who believe that the marketplace is both omniscient, it knows everything; and it is omnipotent, it is all powerful and it will solve everything. Well, I believe the market is really very powerful. But, you know, there are some things that even God can't do. God can't make a square circle, can he? So there are some things that the marketplace won't be able to do.

I do not think that the market signals will be able to be responded to quickly enough to meet this challenge. If there were infinite resources, then this blind faith in the market might have some relevance. But there clearly are not infinite resources. The amount of oil out there is, in fact, finite.

The other is the near worship of scientists and technology: Don't worry, they will fix it. I mentioned to one of our really high officials in government that peak oil was a reality and that it just wasn't going to be there in the future in the amounts that we need for our economy. And he said, Well, I guess when that happens,

the price will go up and people will use less and they will find something else and that solves the problem. Don't worry about it, they will fix it.

Well, I point to two different societies: The Mayan society down in Central America. That didn't get fixed and they are gone. Our cliff dwellers out in the West. I am sure that a number of folks have been there and seen those cliffs, and their world is gone. And I am sure when it was deteriorating, they were saying to each other, Don't worry, they will take care of it.

Easter Island, a vigorous civilization there, and when we finally found the last survivors of it they were living in caves. They were eating rats and each other because they had done, in that little part of the planet, what we may one day do to our total planet; that is, they were living beyond the renewable resources of their little island there in Easter Island and somebody didn't fix it. There wasn't somebody there to fix it.

The next chart looks at a number of the experts and what their predictions are as to when this peak oil that Mr. Markey was talking about is going to occur. And we are now here in 2007 and notice that there is a large number of them here: Colin Campbell, Kenneth Deffeyes, Matt Simmons. Several of these I know personally. And their predictions are all in the very, very near timeframe. As a matter of fact, Deffeyes believes that we now have passed peak oil. He said he used to be a prognosticator and now he is an historian. He is now looking back at the event of peak oil. And then we have a few that believe it will be between 2010 and 2016. And then CERA. CERA is the largest one here. Shell. No visible peak. Very few who believe that it may be some time off in the future.

We will have an opportunity in a few moments to talk about CERA and some of their projections. But notice that most, the large percentage of all of those who have been looking at this and studying this believe that peak oil is either present or imminent.

The next chart is a really interesting one. And if you had only one chart to look at, this I think is the most instructive of all of the charts that we have because on this one chart, it shows the discovery, and that is the large bars here. And you see that back in the 1940s we were discovering lots and in the 1950s, and, boy, in the 1960s and 1970s huge amounts of oil. But notice what has happened. Since about 1980 it has been down, down, down. And that is in spite of ever better technologies for discovering oil and ever better incentives.

When Reagan came to office, that was in 1980, and we were already 10 years down the other side of Hubbert's Peak; so we knew darn well that M. King Hubbert was right, that the United States had reached its peak and we were sliding down the other side of the peak. And I really liked Ronald Reagan. I can like a person without liking everything that they do. And I thought then and I am more convinced now that his solution to this oil problem was totally the wrong

solution. His belief was that if you gave them a profit incentive they would go out there and find it. So they gave them a profit incentive, and, boy, did they drill. And I don't have it with me, but I have a chart that shows the number of wells that were drilled and how much oil was found. And drilling didn't help. You can't find what is not there and you can't pump what you haven't found. So in spite of ever better techniques like 3D seismic and computer modeling, we now pretty much know what the whole globe looks like geologically except maybe we would like to know a little more about Saudi Arabia and some of

the countries around the Caspian. But largely we are pretty aware of what the geology is, and we know that gas and oil can occur in only certain unique geological formations.

The dark line here represents the use of oil. And you see that for a long while we were finding enormously more oil than we were using. But from about 1980 on, we were finding less and less and using more and more.

By the way, notice this little blip here in the 1970s. This is the result of the Arab oil embargo, and had this curve kept going up at the rate it was before, where would it be? There was a stunning statistic up through the Carter years, through this time; every decade we used as much oil as had been used in all of previous history. Wow. What that says is that when you have used half of all the oil in the world, there would be what, one decade left at current use rates? Now, obviously, that couldn't happen because you are not going to use it and then fall off a cliff at the end because the last remaining oil is going to be harder and harder to get. But since about 1980 on, we have now been eating into or reserves, and you will have to take some of this surplus here and fill in this area here. And then what will the future look like?

This chart presumes that it will peak in about 2010. And you can make the future, within limits, look differently, depending upon how aggressive you want to be in using enhanced oil recovery and if you want to drill everywhere in the world the equivalent of the half million wells that we have drilled in this country. If you drilled 10 wells rather than one in the Oil Patch, you obviously would get the oil out quicker. You are not going to get any more oil out probably, but you will get it out more quickly.

So there may be some argument about what the future looks like, but there can be no argument that you can't pump what you haven't found. Now, if you put a smooth curve over this discovery curve, the area under that curve represents the total amount of our discoveries. That is the equivalent of adding up all these little individual bars. And if you look at the area under the use curve, that will be the amount of oil that we have used.

Now, obviously, at the end of the day, those two areas are going to be the same. So unless you think that we are going to reverse this discovery curve and find a lot more oil, and some people do think that, by the way, and we will talk about that in a few moments, but unless you think that we are going to find a lot more oil, the future cannot look very much different than this because you can't pump what you haven't found.

[Time: 15:30]

Because you can't pump what you haven't found, and the area under this discovery curve cannot be different than the area under the use curve. There are many people who are projecting uses that would just indicate that we are going to have to find enormously more oil in the future. One of those projections is in the next chart.

This is from our Energy Information Agency, and this is projections of discoveries. Now, they didn't draw a really smooth curve. They took in some of the big humps, but they could have smoothed this whole thing out.

This is the discovery curve we were just looking at. I think you can recognize that, way up here in the seventies and down, down, down since then. Back in about 2000 they were projecting what we would find in the future. Now, they used some very interesting assumptions here.

The USGS has done a series of simulations. They have some computer modeling, and they have done a whole series of computer modelings, thousands of these, with different inputs. If this was true, if that was true, then what would the likely amount of yet-to-be-discovered oil be. And they have charted those things, and they have the frequency on the ordinate, and on the abscissa they have the amount of oil yet to be found.

Now, this is all a computer game. They simply are making some guesses, assumptions; and they are putting those into this computer model and they are running that model; and as they change the assumptions, they will change the amount of oil they think we will find.

So they have gone to the midpoint of that, and they have said that was F, they call it F, and somehow that got distorted to P and they are now talking about probabilities, which is just bizarre, because these are not probabilities. But this is the fraction of oil that you will find more or find less than this.

So what did they have here? Three of these curves. They have the P-95, that is 95 percent probability they say. Then they have the P-50. That is really F-50 in the data they took this from. And then they have the 5. What they are saying is

that since 50 is halfway between 5 and 95 it is the mean and therefore that is the most probable. So their projection when they made the chart was that this downward slope was now going to be reversed and we were going to start going up.

Of course, if they really are probabilities, and it didn't start as that, it started as these fractional things, but it ended up being projected here as probabilities, if they really are probabilities, there should be another green line down here and another blue line down here.

It is like that little funnel-shaped thing you see from the hurricane. Tomorrow you are pretty certain where it is going to be. The day after tomorrow, you are less certain, so that gets to be a big funnel as you go out. So that is what these various probabilities are.

Now, not surprisingly, the actual data points have followed the 95 percent probability. If you say those are probabilities, obviously this 95 percent probable is a whole lot more probable than 50 percent probable. But for what it is worth, the actual data points for a decade or so have been following the 95 percent probability.

The next chart, this is from the Hirsch Report. I might digress for a moment to note what the Hirsch Report is. There have been two major studies that are financed by our government. One was financed by the Department of Energy and that was SAIC report. Dr. Hirsch, which is why this is called the Hirsch Report, Dr. Hirsch was the leading investigator on that, and this came out, oh, a year-and-a-half ago roughly. I think we will have some quotes from it a little later. But they looked at this situation, peaking of world oil production, impacts, mitigation and risk management. It is going to peak. What should we do about it, what can we do about it, is what was in this report.

This is one of the charts from this report, and these are USGS estimates of ultimate recovery. This is the F that I was talking about. They somehow changed it to P. But this is low, 95 percent; high, 5 percent; and the mean, or expected value, 3,000.

Just a word about what these numbers are. These are thousand gigabarrels. Now, we use gigabarrel because a billion in England, I understand, is a million million. A billion in this country is a thousand million. So if you are talking about billions, you may confuse some people. But apparently everybody knows what a giga is, and a giga is our billion. So we are talking about gigabarrels of oil.

So this is 2,248 gigabarrels of oil. That is about, what, 2,000 gigabarrels of oil. That, by the way, is roughly the amount of oil that most of the world's experts believe we have found, and we have used about half of that. We have used

about 1,000 gigabarrels of oil, so there are about another 1,000 that we have yet to use.

But what this prognostication indicates is that we are going to find as much more oil, another roughly 1,000 gigabarrels to bring this 2 up to 3, we are going to find as much more oil as all the oil that is still left in the world. Now, that is conceivable. I think it is about as likely as winning the lottery. I don't think there is much probability of that happening.

But even if that was true, and that is the stunning thing that this chart shows, even if that is true, that only takes the peak out to 2016. That is just around the corner. That is 9 years away, even if that is true.

This is the power of the exponential function. One of the most interesting lectures I have ever heard was given by Dr. Albert Bartlett, emeritus, University of Colorado, no relative of mine. I wish he were. I wish I had some of his genes. He gives some fascinating explanations of the exponential function. One of them I think is worth spending just a moment on.

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The story is told that chess was developed in an ancient kingdom, and the king was so pleased at the invention of chess that he asked the inventor to come in and he promised him any reasonable thing. And the inventor of the chess game said, O, king, I am a very simple person. I have simple needs. If you will just take my chess board and put a grain of wheat on the first square and two grains of wheat on the second square and four grains of wheat on the third square and eight on the fourth square and keep doubling until you have filled all of the 64 squares on my chess board, that will be reward enough.

The king said to himself, simple fellow. He could have asked for something meaningful, and all he has asked for is a few grains of wheat on a chess board. Of course, the king could not deliver, because it is my understanding that it would take the world's harvest today of a decade to fill the chess board. That is the power of exponential growth.

Albert Einstein was asked about what the next great power in the universe would be after the discovery of nuclear energy, and he said the most powerful force in the universe was the power of compound interest.

Well, Dr. Albert Bartlett's fascinating 1-hour lecture, and just do a Google search for Dr. Bartlett, Albert Bartlett and energy, and you can pull it up, and he has some very interesting illustrations in there.

He says the biggest failure of our industrialized society is the failure to understand the exponential growth. But even if we were to find as much more oil as all the oil that now exists, it would push the peak out to only 2016.

Now, if you use enhanced oil recovery and pump a lot of CO2 down there and live steam and so forth, maybe you can push it out to 2037, but look what happens after that. Then you fall off a cliff, is what they say in this prognostication.

The next chart is an interesting chart from CERA. In an article entitled ``Undulating Plateau Versus Peak Oil,'' it says there is not going to be any peak. I looked at this, and, by golly, it looks like a peak to me. It goes up and then it comes down.

Now, they have several different assumptions in here, and they are pretty easy to sort out, I think. This is roughly that 2 trillion, the current known amount of oil; and if that is all the oil there is, they agree that the peak is pretty imminent. But they believe that we are going to find about as much more conventional oil as still exists in reserves. If that is true, then the peak moves out only this far.

Then they think we are going to get a lot of oil from the unconventional oil sources, like the Canadian tar sands and our western oil shales and the really heavy oil from Venezuela; and if we get that, then we are going to go up that high plateau. But this is still a plateau

I have 10 kids, 15 grandkids and 2 great grandkids. Wouldn't it be nice if we left a little energy for them? We are bequeathing them, not with my votes, but we are bequeathing them the largest intergenerational debt transfer in the history of the world. I would like to leave them a little energy, thank you, which is why I don't vote to drill in ANWR and I don't vote to drill offshore. I think there is a real moral element to this discussion.

If we are going to bequeath them this horrendous debt, which I think is immoral in itself, then I think it is doubly immoral that we give them a world from which we have raped all the readily available energy. Someone suggested in the future they may look back at what we have done and say to themselves, how could the monsters have done that? I hope that they won't be able to say that about this generation, because I hope that we will do better.

Well, this curve that they meant to repudiate, peak oil, I think confirms there will be a peak oil.

The next chart here is a statement from one of the experts in this field, Dr. Laherrere, and this is what he says. The USGS estimate implies a five-fold increase in discovery, to reverse the current trend, which is going down, and it is going to go up, a five-fold increase in discovery rate and reserve addition for

which no evidence is presented. Such an improvement in performance is in fact utterly implausible, he says, given the great technological achievements of the industry over the past 20 years, the worldwide search and the deliberate effort to find the largest remaining prospects.

And we found a pretty big one just recently out in the Gulf of Mexico, under, what, 7,000 feet of water, roughly 30,000 feet of rock. If you notice, they aren't developing that yet. I am told, and not everything I am told is true because it is sometimes hard to get the correct facts, but I am told that they will start developing that when oil is $211 a barrel, because that is what it is going to cost to get it out of there. I am not sure whether that is true or not.

The next chart, I mentioned the oil chart that we showed before as being the single chart I would use if I had only one. If I was awarded two charts to use to talk about this, this would be the second one I would use, the upper part of it. This is a really revealing chart.

This goes back through about 400 years of, I generally say 5,000 years of, recorded history. Hyman Rickover referred to it as 8,000 years of recorded history.

I might digress for just a moment. I hope to come to the floor the 15th of this May to talk about a really, really interesting speech that Hyman Rickover, the father of our nuclear submarine, gave to a group of physicians in Saint Paul, Minnesota, 50 years ago the 15th of this May.

He notes that we have 8,000 years of recorded history. He said at that time, 50 years ago, we were about 100 years into the age of oil. This now introduces us to that age of oil.

It was introduced, of course, by the Industrial Revolution which started with wood, the hills of New England, the mountains that were denuded, taking charcoal to England to make iron. Up in Frederick County, which I have the honor of representing, there is Catoctin Furnace up there, which is a little smelter up there, and they denuded the hills up in Gambro where Camp David is. They denuded those hills to make charcoal for that furnace. It is now a historic site. The Industrial Revolution began with the use of wood. The Stanley Steamer used wood.

On the ordinate here is the quadrillion BTUs. This is a measure of the total amount of energy produced. Notice that is pretty far down here. Then we found coal. Boy, then the Industrial Revolution took off. But it really took off when we found gas and oil. And notice how that is standing up on end. And notice what happened at the Arab oil embargo here in the seventies.

[Time: 15:45]

Where would we be if that hadn't happened? That was really a wake-up call. As a result of that, we have enormously more efficient appliances than we had then. Your air conditioner is probably three times as efficient as it was then. Too bad our cars didn't follow that path, isn't it?

Well, the interesting thing is that the world's population just about followed this curve. For these 8,000 years of recorded history, we had half a billion to a billion people worldwide. Now with the industrial revolution, the population has exploded. We now have almost 7 billion people in the world.

There is, in Hyman Rickover's speech to those physicians 50 years ago, a fascinating discussion of the contribution of energy to the development of civilization.

I hope to come to the floor on May 15 and we will spend the whole hour talking about his speech. It was so prophetic. As a matter of fact, he predicted that if we start making too much energy from a food substance, the price of food will go up. We have made trifling amounts of ethanol from corn, and we have doubled the price of corn. We are hurting the poor people who use tortillas because they are made out of corn. My dairymen are financially dying because the price of corn has doubled and the price of milk does not justify that feed cost. They are losing money month by month.

Well, this is striking symbolism here. In another 100-150 years, we will be down the other side of the age of oil. This is going to fall off.

Is there any reason that the world shouldn't follow the microcosm of the United States? M. King Hubbert predicted in 1956 that we would peak in 1970. We did. He predicted the world would be peaking about now. If he was right about the United States, why

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shouldn't he be right about the world, and why shouldn't we have been doing something about that?

Since 1980, we have known very well that M. King Hubbert was right about the United States. If he was right about the United States, maybe he would be right about the world. If it is true that the world's oil production would peak about now, then no matter what we do, drill a half million wells, like we drill in the United States, which would be millions worldwide, it still goes downhill no matter what we have done. Our production is downhill.

Very interesting, in 8,000 years of recorded history, the age of oil will be but a blip: 300 years. What will our world look like? Our next chart introduces us to that.

Sooner or later, whether we like it or not, we will transition from fossil fuels because they will one day be gone. We will transition from fossil fuels to renewables. This chart looks at the options that we have. We have some finite sources, and we need to come back for another hour and talk in detail about some of these finite sources that we have here and what their potential is, and then let the listener judge as to what contribution they think will be made from this.

One of the challenges we have is the fantastic density of energy in our fossil fuels. One barrel of oil has in it the energy equivalent of 12 people working all year long. Hyman Rickover gives some fascinating examples in his speech to those physicians nearly 50 years ago. He said that each worker in the factory had at his disposal the power equivalent of 244 men turning the wheels and so forth; that every family had the mechanical system, stoves and vacuum cleaners, toasters, that represented the work of 33 full-time faithful household servants. He said 100,000 men pushed your car down the road, and the equivalent energy of 700,000 men pushed a jet plane through the sky.

Two little examples to help realize this, just think how far one gallon of gasoline or diesel, how far that one gallon of gasoline or diesel takes you. I drive a Prius. It drives 50 miles on a gallon. How long would it take me to pull my Prius 50 miles?

If you go out and work really hard all day, I will get more work out of an electric motor for less than 25 cents worth of electricity. Now energy-wise electricity is about half the cost of gasoline, but about 25 cents worth of electricity, and that may be humbling to represent that you are worth less than 25 cents a day in terms of fossil fuel, but that is the reality. And that is why we have such an incredibly high standard of living, we have this incredible energy source at our disposal.

The challenge is to transition to renewable forms of energy that will provide the same quality of life. We have some finite resources that we can go through. The tar sands, the oil shales, the coal, nuclear fission, nuclear fusion. We don't have time today to talk about these in detail. We will come back and talk about those in detail. And then all of the renewables. These will one day be gone, except for nuclear. We will talk about nuclear. If we ever get fusion, we are home free. I think that is most unlikely. If we go to breeder reactors, we buy some problems, but then we have relatively secure energy if you can handle the waste, and so forth, from that.

But there are only so much tar sands, oil shale, and coal. They come at great expense. They are pretty polluting processes. Ultimately, we will be down here,

getting all of our energy from these resources: Solar, wind, geothermal, ocean energy, agricultural resources, soy diesel, biodiesel, ethanol, methanol, biomass.

Now there is a lot of talk about cellulosic ethanol. I understand the President on television was saying that there is going to be limited amounts of energy we can get from ethanol because already we have doubled the price of corn. So now we need to turn to biomass, to cellulosic ethanol.

Cellulosic ethanol is liberating the glucose that is so tightly bound in the starch molecule that enzymes in our body can't liberate it, but there are microbes that live in the guts of the wood-eating cockroach, cryptocercus, and in the stomach of cows and sheep and goats and so forth that does that for them. So the cellulosic ethanol is liberating the glucose from the big cellulose molecule.

Waste energy. Just a word of caution, that huge stream of waste we have is the result of profligate use of fossil fuels. In an energy deficient world, there will be nowhere near as much waste as we have now. We jolly well ought to be using the waste energy now. It is a much better use of this waste than burying it in a landfill, but it will not be the ultimate solution to our problem.

Hydrogen. I want to make sure that everyone understands that hydrogen is not an energy source. We talk about it because when you burn it you get water that is pretty darn clean, and it is a great candidate for fuel cells, if we ever get fuel cells. Think of hydrogen as a battery, something to carry energy from one source to another.

We have only a few moments remaining, and I would like to put the last chart up. That will introduce us to a longer discussion we will have next time.

We are very much like the young couple whose grandparents have died and they have inherited a lot of money. They have established a lifestyle where 85 percent of the money they spend comes from their grandparents' inheritance, and only 15 percent from what they are earning.

Here we are getting 85 percent of our energy from fossil fuels and only 15 percent from anything else, and the fossil fuels are not going to last. The kids look at what they are doing and say gee, that is going to run out. We have to do something. Either we have to make more or use less. That is exactly where we are.

A bit more than half of all of this other than fossil fuel energy is nuclear power: 8 percent of total use in our country, 20 percent of electricity, it probably could and should be more than that, and then 7 percent. That is going to have to grow until it is 100 percent, but some don't have much potential for growth.

Conventional hydroelectric, that is peaked out. We will come back and spend a full hour talking about the potential of these. There are exciting challenges here, and I think it will inspire the best of America

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